

# Highway Lighting and Accidents in Indiana

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● **ALTHOUGH** Webster defines a tool as "an instrument of manual operation," in this automotive age a traffic safety "tool" may be defined as anything that can be used to prevent traffic accidents and facilitate the movement of our ever-increasing vehicular volume.

Reduced to its simplest form, traffic accidents involve people: people injured, people maimed, and people killed.

The statement, "We will kill at least one unfortunate traffic victim next year during the hours of darkness at the intersection of US 52 and US 421 (16th Street and Northwestern Avenue)," was made in 1950 at a meeting of aroused traffic safety-minded citizens and public officials in Indianapolis. This statement was based on an analysis of the traffic accident investigation records of the Indianapolis Police Department. It was startling to see the same location appearing as a fatality location year after year. The unanimous reaction to the statement, as could be expected, was "do something about it."

Today, many traffic tools are being used in the efforts to spare people from death, suffering, and disability on streets and highways. Improved road design, divided highways, one-way streets, channelization, truck lanes, left turn lanes, interchanges, signs of all types and descriptions, traffic signals, flashers and directional arrows are familiar to all. There are many more traffic tools that could be mentioned, traffic tools that are used to advantage in Indiana, but none of the traffic tools mentioned or used had the slightest value if drivers cannot see to use it. Sight, the most precious of the five senses, is worthless without light. The sun furnishes 10,000 footcandles of illumination during the day, but, at night, our forefathers discovered that the moon furnished an inadequate amount of illumination, and they placed torches and tapers in front of their homes.

There are now two principal ways of aiding the ability to see in traffic and on highways at night.

One of these methods is the use of automobile headlights. The sealed-beam headlight, recently adopted by Indiana, is a tremendous improvement, especially when driving with the depressed beam. Even so, the majority of people today are generally over-driving their headlights—driving too fast for any factor of safety reaction time.

The second method is proper and adequate street and highway lighting. This method is a proven and important tool for traffic safety, but it is no cure-all, in any sense of the imagination, and should not be considered as such.

The elements of safe seeing (visibility required to locate and identify) are pavement brightness and obstacle brightness. Pavement brightness, or uniformity of background, is necessary for silhouette contrast. Obstacle brightness, which makes surface details visible by direct lighting, is actually more reflectivity from the object than from its background. The absence of glare, the light which is in such contrast to the surrounding area that it actually causes a reduction of visibility, is one more important element.

In Indiana, street or highway lighting is thought of as traffic safety lighting. Many reasons explaining the benefits of proper traffic safety lighting, have been cited but it is generally felt in this area that the most important of these are to assist in the reduction of accidents and fatalities while facilitating the movement of traffic; to assist in the curbing of crime, thus providing additional protection for the general public; and to promote civic progress and community pride, hence helping business in general.

Traffic safety lighting should be installed only when needed and in those locations indicated by night traffic accident statistics. In this manner, the tax dollar is most wisely spent for the most gain. Crime areas, as pointed out by arrest maps and charts, can also indicate locations for traffic safety lighting installations. On one small section of a highway in Indianapolis, armed robberies decreased 75 percent in the year following the installation of modern lighting. It is also interesting to note that, at this same location, the rate of drunks arrested increased by a ratio of eight to one in this same year. No street or road widening project in congested areas is complete unless adequate traffic safety lighting is also provided. Any traffic pattern change, such as a one-way street or

highway, invariably requires street and highway lighting changes to provide proper traffic and pedestrian safety.

There are many items to consider in the proper design of traffic safety lighting. A few of these are street and highway widths, spacing of lighting units, mounting heights, vehicular traffic conditions and patterns, pedestrian activity, and area problems. What light source should be used, incandescent, sodium vapor, mercury vapor or fluorescent? Incandescent lighting is a general purpose source and is the most widely used. The sodium vapor source should be used only for dangerous and hazardous locations to obtain its most effective results. The mercury vapor source is widely used for streets with heavy traffic. Certain objections to its color distortion have been overcome by color-corrected mercury lamps. Fluorescent lighting, the most recent source for street and highway use, has the least glare, allowing its use in underpasses and tunnels, as well as on streets and highways.

But, what of highway lighting on Indiana's 85,179 miles of state and county roads where a traffic crash occurs every six minutes, a traffic injury every sixteen minutes, a traffic death every eight hours, and where over 100 million dollars is lost each year? Is this traffic safety tool being used to advantage? Did street and highway lighting contribute to Indiana's outstanding traffic record of saving almost 200 lives in 1954 and almost holding this gain in 1955, despite the increased vehicular miles driven and approximately 79 percent of the total traffic fatalities occurring in rural areas?

By reviewing the history, of highway lighting in Indiana, a determination of its present standing can be made. The State Highway Commission Act of 1937 provided: "The State Highway Commission is hereby authorized and empowered, whenever such commission deems it advisable for the safety of traffic, to illuminate dangerous curves and intersections on the highways in the State Highway System, and also the bridges of such system. The cost of the installation of such lights, may be paid out of the funds appropriated to said commission for 'miscellaneous service' and the cost of maintaining such lights shall be paid out of the funds appropriated to said commission for the 'maintenance of highway'."

In the latter part of 1937, the first highway lighting under this act was installed on US 20, near Michigan City. Approximately one mile of lighting was placed along a section of roadway with a high frequency of fogs and night accidents. To this day, a better night accident record than any section of US 20 across the entire state has been maintained, although the lighting is actually inadequate for present traffic conditions and vehicular volume. These lights were installed and have been operated and maintained by the local utility company.

In the following years, as is often the case, very little additional lighting was installed, but state officials recognized, in 1949, the safety possibilities of highway lighting. Knowing the accomplishments in Indianapolis, they began to plan for new installations. However, certain state officials felt that the Highway Act of 1937 did not provide full and clear authority for continuous lighting installations. Consequently, an attempt was made in the legislature to amend the 1937 Act by inserting: "Said Commission is further authorized and empowered to illuminate any portion of a highway or highways in the State Highway system outside incorporated cities and towns, where, in the opinion of said Commission the character and density of traffic require such illumination for the safety of the public."

Unfortunately, the amendment was introduced in the latter part of the 1949 legislative session, and, although reported out of committee favorably in the House of Representatives, it was caught in a last minute legislative jam and was never acted upon by the house members. In 1951, the same bill, with a preamble aimed directly at a particularly dangerous section of Indiana 40 outside of Indianapolis, was introduced and became House Bill 98. It was passed in the House of Representatives with only one dissenting vote and unanimously in the Senate. It is well to emphasize the fact that this bill, while clarifying the situation with respect to continuous lighting, does not provide the State Highway Commission with the power to illuminate sections of roads or highways within the corporate limits of cities and towns. It is felt that the cities and towns should provide their own tax funds for such lighting. It can be readily seen that, in many instances, the lighting requirements within cities and towns are much greater than those required for the lighting of highways in less congested urban areas, and the light level is often above that required for traffic safety. However, the state can still illuminate isolated or specific

locations within the corporate limits of cities and towns should it so desire, and, in a number of locations (particularly in Indianapolis) it has done so.

Oddly enough, the section of Indiana 40 referred to in the preamble of House Bill 98 has never been illuminated. The lighting project was not ordered until the latter part of 1955, and is now being installed by the Indianapolis Power and Light Company.

For a number of years, there has been in existence in Indiana, a Highway Lighting Committee, representing the Indiana Electric Association, an organization composed of six privately-owned utilities. Members of this committee are experienced lighting engineers and their respective companies blanket the entire state. In 1951 and 1952, this committee began to work closely with engineers of the Division of Traffic of the State Highway Department. As a result, several minor lighting installations were completed.

The services of this Committee were also requested by the Indiana State Police to lay out and design proper lighting facilities at 17 truck load weighing stations at check points scattered throughout the state. The purpose of these lighting installations was to protect the police personnel and to provide visibility for truck drivers entering and emerging from the load weighing zones. The success of these lighting installations, which averaged approximately 15 lights each, developed an immediate interest in highway lighting among the members of the State Police organization.

The 1953 Indiana General Assembly, through House Bill 74, established the Office of Traffic Safety, which began its operations on May 1, 1953. This office is administered by a Director of Traffic Safety appointed by the Governor and is responsible for the development and conduct of an effective statewide traffic accident prevention program. Major duties of the office include working closely with the various governmental departments and agencies on the development and conduct of effective traffic safety activities and coordinating these activities into a strong attack on the traffic accident problem. The services of the Highway Lighting Committee were immediately offered to the Office of Traffic Safety; and, after several meetings, the committee met with engineers of the Division of Traffic and developed jointly a highway lighting program for Indiana. This program is based on the principle of providing proper and adequate illumination in those sections of highways where state police traffic statistics indicate a definite need for highway lighting. This principle insures the prudent use of the state tax dollar and essential immediate protection to the motoring public in those locations where the most benefit should be forthcoming.

After considerable study, it was decided that highway intersections, bridges, dangerous curves, dead ends, traffic interchanges, underpasses, railroad crossings, and congested approaches to cities and towns should receive priority treatment since they constituted the major traffic hazards for which lighting would prove most beneficial. According to state police statistics, there was a total of 30,760 accidents in rural areas in 1954. These accidents were broken down as follows: daylight 18,292; dusk 1,242; dawn dawn 367; darkness, with street lights 174; darkness, without street lights 10,672, and not stated 15.

The statistics indicated that 40 percent of all the accidents in rural areas occurred at night, with only an estimated one-third of the traffic volume flowing. They also indicated that 50 percent of all rural accidents in which one or more fatalities occurred were also at night. Twenty-three percent of all rural accidents occurred at intersections, and 4½ percent occurred at railroad crossings, bridges or underpasses.

Adequate night visibility and protection at minor intersections, such as a county or local road and a highway route, can often be accomplished by simply installing two overhead lights. However, major intersections and crowded areas are considerably more complex. There are two basic factors which must be considered: average vehicular speed and average eye adaptation time. They can actually determine the required length of lighting to provide adequate traffic safety for the motorist. The adjustment of the pupil of the eye while driving with headlights on a highway and entering or leaving a lighted area is of extreme importance. For example, consider the effect on eyesight when one enters a lighted room from a dark area or the reverse situation. Until eyes can properly adjust themselves to the changing light conditions, vision is temporarily impaired. On a highway, that instant may be one's last. In a period of three years, in a one-block section of Indiana 40 in Indianapolis, there were five fatal accidents at night;

all were pedestrians crossing the street; all were killed by motorists traveling in the same direction.

Actually, the solution to the problem was childishly simple. Motorists had been traveling west on well lighted streets up to this particular block, and it was like driving into an inkwell; the drivers just did not see their unfortunate victims. Their eyes could not make the required adjustment. The lighting was improved, and there has been only one night fatality during the following eight years, in this particular block.

The general pattern adopted for lighting highways assumes a speed of 60 mph with 10 seconds of eye adaptation time. This means, for example, 880 ft of proper illumination will be provided in all directions from a highway intersection, beginning with a light level of approximately .5 footcandles and tapering up to 1 or 1½ footcandles at the road intersections. This level of lighting generally follows, or is better than, the "American Standard Practice for Street and Highway Lighting." Additional field studies and observations, following several installations of highway lighting, have revealed that speeds are lowered through lighted areas. Experiments are now being made with illuminated areas of 400 to 600 ft, based on approximate speeds of 45 mph and 10 seconds of eye adaptation time. This would mean that for the 60-mph driver a reduction in eye adaptation time to 5 - 7 seconds is necessary. Additional research on speed in lighted areas approaching intersections is planned jointly with the Traffic Division of the State Highway Department and the Road Research Division of Purdue University.

It is readily seen that, with less length of roadway to illuminate, the lighting cost will be reduced providing funds for additional coverage. Eye adaptation time is a problem, and Indiana welcomes information on the subject and ideas for practical research, since sufficient data for definite conclusions are not available at this time.

The 10,000 lumen incandescent lamp has been accepted, generally, as the lamp source and lamp size to be used for highway lighting service, since it provides versatility using the same equipment. If traffic increases, lamp size can be increased to 15,000 lumens, raising the light level but still using the same luminaire.

In certain circumstances, there are installations using other light sources, and the state plans to harmonize its lighting installations with those of the municipality in areas adjacent to cities and towns. All of the facilities are installed and owned by the companies or municipalities providing electrical service. These same agencies operate and maintain all equipment based on a flat-rate charge per light per year. Maintenance includes, of course, the replacement of all burned out lamps. Lamps are group-replaced at approximately one-half of the locations. The type of construction is uniform; the majority of the systems employing wood poles, using overhead wiring, and following standard street lighting construction standards. One exception to this is the traffic interchange at US 40 and Indiana 100, near Indianapolis, which will have metal standards and underground cable. Whenever possible, the poles are installed at a distance of 11 ft from the pavement edge. This permits the use of 12-ft and 16-ft mastarms to locate the lighting fixtures over the roadway proper. Mounting heights are usually from 27 to 30 ft above the pavement. In all instances, the installations are covered by written agreements (for terms of five years or ten years) and are executed on behalf of the State of Indiana by the State Highway Department. Requests for lighting installations are normally forwarded by the Traffic Division of the State Highway Department directly to the particular utility company serving the area.

In all cases, traffic statistics are obtained from the files of the State Police Department Accident Records Bureau and the Indianapolis Police Department Traffic Division. As an example, the statistics for a one year period covering that section of Indiana 40 referred to in the Preamble of House Bill 98 show that accidents by light condition were as follows: daylight 92; dusk 6; dawn 1; darkness, highway lighted 7; darkness, highway not lighted 71 with 5 fatalities. This represents a total of 177 accidents and five fatalities, analyzed in Table 1.

In the total reported accidents, five people were killed, 25 received severe injuries, and 70 reported minor personal injuries. The aggregate property damage was estimated at \$55,000.00 over a twelve month period. The comments of the Accident Record Bureau were very pertinent: "Although 52 percent of the reported accidents occurred during the hours of daylight, night-time accidents on locations not lighted were ten times

**TABLE 1**  
**ANALYSIS OF 177 ACCIDENTS ON A SECTION OF INDIANA 40 DURING A**  
**ONE-YEAR PERIOD**

Accidents				
Type	Number	Fatalities	Injuries	Property Damage
Collision with pedestrian	11	4	7	-
Collision with other vehicle	150	1	41	108
Collision with fixed object	2	-	1	1
Vehicle overturned	1	-	1	-
Ran off roadway	12	-	3	9
Other non-collision	1	-	-	1
<b>Total</b>	<b>177</b>	<b>5</b>	<b>53</b>	<b>119</b>

as frequent as those in lighted areas. Also all of the fatal accidents occurred during hours of darkness at locations not lighted. Since four of the five traffic deaths were pedestrians, it is reasonable to assume the visibility factor would rate high as approximate cause."

Highway traffic safety lighting has been installed or is on order for approximately sixty locations throughout Indiana. These installations vary in number of lights from one to 175 at a particular project. Approximately 500 highway lights are now installed and in service with another 300 in the process of being installed. All of these lights are being paid for by the State of Indiana on a flat-rate basis. In the majority of cases these lights are turned on and off by a photo-electric cell control. They are lighted approximately 4,060 hours per year. The average pattern at an intersection of two highway routes has been four lights at the intersection and three lights in each of the approaches to the intersection. For a total of sixteen lights, the spacing of the lights is usually staggered except at the intersection and gradually increases away from the intersection to a maximum distance of 175 ft.

Only a few of the isolated installations have been in service long enough to obtain reliable before-and-after accident information. However, the available results are interesting.

The intersection of Indiana 37 and 100 is located northeast of Indianapolis. It is a high-speed, signalized intersection, and it had a night record of four accidents and ten fatalities in a three-year period prior to lighting. In the four-year period following the installation of two overhead lights, there were six accidents at night and one fatality.

At one end of a new by-pass near Martinsville, Indiana 67 crosses Indiana 39 in a T-intersection. In a one-year period, four night accidents occurred—caused primarily by motorists over-driving the by-pass turn and being struck from the rear. In the one year following the installation of adequate intersection and approach traffic safety lighting, only two night accidents have occurred, although traffic has increased considerably. Neither of these accidents was caused by turning vehicles.

At the intersection of Indiana 51 and US 20 near Gary, there were three fatalities in eleven night accidents in the year prior to the installation of five lights. The following year, there was only one night accident.

The overall effect of the lighting program can be examined in Indianapolis, which is a city with 60 miles of state highway routes and approximately 500,000 population. In the last four years, 213 traffic fatalities have occurred on traffic, truck, and state highway routes with only 10 on strictly residential streets.

In 1950, there were 217,451 motor vehicles registered in Indianapolis. This increased to 266,154 at the end of 1954 with one car for every two people. In 1950, there was a total of 13,374 street lights. This total has been increased until there were 17,094 street lights as of December 15, 1955. In addition to the installation of 4,020 new street lights, 3,783 were replaced with modern lighting units and increased in lumen output. Night accidents gradually decreased. In 1950, there were 3,826; in 1951,

3, 681; in 1952, 3, 276; in 1953, 2, 954; and in 1954, 3, 029. Since a majority of the new lights and practically 100 percent of the modernized lights were installed (based on locations from police accident statistics), it is reasonable to believe that the lighting improvements were major contributions to the reduction in night accidents.

The Office of Traffic Safety has used \$1, 250 as the average cost per accident during 1954. By a simple application of arithmetic, it is readily seen that the accident reduction savings in dollars per year far overshadows the cost of this lighting program.

The decision to re-light the intersection of US 52 and US 421 (16th Street and Northwestern Avenue in Indianapolis) proved to be a wise one. In the two years prior to re-lighting this intersection, which carries a heavy rush hour traffic load in addition to normal state highway travel, there were 54 accidents during the day with no fatalities, and 60 accidents at night with 2 fatalities. Following the installation of proper lighting, the two year period had 53 day accidents and only 45 night accidents with no fatalities at any time.

South Street in Indianapolis is a heavily traveled, one-mile truck route with considerable night traffic. In one year prior to re-lighting, there were 71 night accidents with one fatality. The following year there was one fatality with only 45 night accidents.

A two mile stretch of US 52 and US 136 along 16th Street carries a very heavy volume of Indianapolis-Chicago traffic, and it passes through a small business area with used car lots and by the local ball park. The lighting in this area was modernized at an annual cost to the city of \$5, 900. In the year prior to re-lighting, there were 60 night accidents, but there were only 40 night accidents the year after.

The results of these and many other installations of traffic safety lighting over a period of years in Indianapolis have proven that proper street and highway lighting can save lives, injuries, and property damage.

One of the problems facing the highway engineer of today is that of unlighted trains crossing state highway routes. An increasing number of motorists are crashing into the sides of these trains. Such a problem existed on Indiana 67 at the Belt Railroad southwest of Indianapolis. In two years there have been 11 day accidents and 9 night accidents including one night fatality at this railroad crossing. A study revealed that the majority of the accidents at night were caused by motorists who were apparently over-driving their headlights and who usually skidded into the sides of the trains. The installation of one overhead sodium vapor light at this railroad crossing produced the following results in 1½ years and prior to the time a grade separation underpass was built: day accidents continued with a total of 10, but night accidents were reduced to 2. A study is now being made throughout Indiana as a result of this study, two overhead lights will probably be installed at many of the railroad crossings with high incidents of night traffic accidents.

Some amateur traffic experts believe that the effectiveness of flashers (in particular those which flash amber in one direction and red in another) is exaggerated.

They are a dangerous, often mis-used tool. A flashing light, regardless of color, even red, means "Caution, Slow Down," to an amazing percentage of drivers. At a recent state traffic meeting, one of the state legislators was asked what a flashing amber light meant to him and what a flashing red light meant. His answer was that a flashing amber light meant "Be Cautious" and that a flashing red light meant "Be Extra Cautious." Far too often a driver will stop at an intersection with a red flashing signal—only to pull directly in front of another car driving through the amber flasher. Flashers are often used for no other purpose than to indicate a crossroad with considerable turning volume. The same job can be done by the installation of two overhead lights, and the same warning as flashers (plus the advantage of visibility) will be provided in many cases at less cost.

In summary, here is a five-point program for traffic safety.

1. Strict enforcement of all traffic laws by a full complement of police traffic officers using all available enforcement tools.
2. Strict and impartial policy by all courts, with particular emphasis on repeat violators.
3. Removal of habitually reckless and dangerous drivers from the streets and highways.

4. Increased efforts by all individuals and organizations along every line of safety education and promotion.

5. Continuous application and use of all modern engineering, construction, and traffic facility improvements and tools.

Certainly, highway lighting is one of these tools.